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Chemically stable diphenylalanine peptide microtubes: structure, properties, application.

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The diphenylalanine (FF) is one of the self-assembling peptides which have recently become a focus of intensive research in the field of nanomaterials due to its promising applications in various technological fields [1]. FF structures possess unique physical and chemical properties such as high rigidity [2], unique optical properties related to quantum confinement of electrons and holes [3], appreciable thermal stability as well as exceptional piezoelectric effect [4] and ferroelectricity [5]. FF structures have shown great potential to be employed in nano and micro devices [1,5,6]. The chemical stability of these structures is a necessary prerequisite for their successful application. However, in solution, the peptide nanotubes can easily be dissolved in several solvents including water. The instability of FF tubes in solution is a major limitation to realizing FF structures.

In the present work we report the results of our recent studies on the growth and characterization of chemically stable microtubes from diphenylalanine. The stable microtubes were fabricated by modifying well-known procedure [7], they were grown in a solution with a low water content. The modifications introduced into the procedure led to the formation of large microtubes that remain stable in the aqueous environment for at least 21 days. These materials were characterized by scanning electron microscopy, X-ray diffraction techniques, RAMAN spectroscopy for determining the structure of microtubes. It was established that obtained tubes have cyclo-diphenylalanine (cycloFF) structure. CycloFF is an FF derivative. The mechanism of tubes formation under these conditions is discussed. The piezoelectric and mechanical properties of obtained microtubes were investigated. It was found, that piezoelectric coefficients are comparable to that for FF tubes, Young's modulus is several times smaller than that of FF tubes.

Thus, the obtained chemically stable microtubes are an attractive material for the fabrication of future generation of micro devices.

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